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1.0 INTRODUCTION

CDW Consultants, Inc. (CDW), on behalf of our client, City of Waltham, has conducted a supplemental subsurface investigation on the properties located at 225-227 and 240 Beaver Street, Waltham, Massachusetts (Figure 1, “Site”). The investigation included the advancement of soil borings and hand-driven borings, and soil sampling and analysis. This investigation was conducted in November and December 2019. The investigation was conducted in order to further delineate areas of potential environmental impact following the prior Phase II Limited Site Investigation.

1.1 Purpose

The purpose of the investigation was to evaluate subsurface conditions in an apparent dumping area on the southern side of 240 Beaver Street, and potential dumping areas located in the woods at 225-227 Beaver Street. In addition, the investigation included delineating potential impacts to the wetland area at the southeast portion of 225-227 Beaver Street from the Phoenix (“fly ash”) project conducted in the 1970’s. This investigation was performed in accordance with Massachusetts General Law (MGL) Chapter 21E.

1.2 Site & Surrounding Area Description

CDW previously conducted an ASTM Phase I investigation of the properties listed as 240 Beaver Street and 225-227 Beaver Street, in Waltham, Massachusetts (the “Site”; Figure 1). The assessment includes one 27.9-acre parcel located at 240 Beaver Street and one 30.84-acre parcel located at 225-227 Beaver Street. Both properties comprise the University of Massachusetts Agriculture Experiment Station that was gifted to the Commonwealth in the early 1900s for educational purposes. The property is still owned by the University of Massachusetts (University).

Parcel 1 (240 Beaver Street) consists of administration buildings, greenhouses, a research area, small community garden plots, and agricultural fields. This parcel is bounded by Beaver Street to the north, a baseball field and Waverly Oaks road to the east and southeast, Marianne Road to the south, and Linden Street and the residential properties at Linen Circle and Floral Circle to the west. The southern parcel (referenced as parcel #1) is located at 240 Beaver Street and is improved with a 7,474 square foot administration building built in 1948. The three-story building has approximately 20 offices and an attached auditorium of approximately 5,000 square feet. It is currently used for office space and is known as the main building of the Waltham Experiment Station. The parcel also contains the Gray Workshop Building with four attached greenhouses, a Boiler Building that formerly generated heat for the buildings, the Corn Laboratory with two attached greenhouses, and hoop-style greenhouses. The Administration Building, Gray Workshop Building and the Boiler Building are the main structures currently in use. The parcel is bordered by the Cornelia Warren Ball Fields to the east, Waverly Oaks Road- Route 60 to the south and a residential neighborhood to the west. Access to Parcel 1 is via three gravel driveways that enter the site from Beaver Street. Two driveways provide access and parking along the east, west, and south side of the Administration Building and the other provides access along the eastern side of the Gray Workshop Building with parking on the south side of the building.

The Parcel 1 buildings are connected to municipal water, sewer and natural gas. The Administration Building was formerly heated with #2 fuel oil, supplied by two 7,500-gallon underground storage tanks (USTs). The Gray Building was heated with #2 fuel oil, supplied by one 1,000-gallon UST. All known USTs have been removed.

Parcel 2 (225-227 Beaver Street) consists of an abandoned farmhouse and dairy farm buildings including barns, storage sheds, and foundation structures for former buildings. Most of these structures are in disrepair and several have collapsed. The upland field west of the wetland was used for hay production and grazing. The eastern portion of this parcel contains approximately 16 acres of wetlands, meadow and succession forest vegetation. The wet meadow and wetland areas were not developed. The parcel is bounded to the northeast by the Fernald State School, to the south by Waverly Oaks Road and Beaver Street, to the west by Camp Cedar Hill and associated buildings owned by the Girl Scouts of Eastern Massachusetts, and to the east by Waverly Oaks Road. The wetlands contain an approximately 4,600 square feet area of fly ash material brought from an off-site source used for an agricultural research experiment conducted in the 1970's known as the Phoenix Project (a joint USEPA, Mass DEP and MA DPW project).

The Site is located on the Boston Southwest United States Geological Survey (USGS) 1987 Quadrangle Map at the following approximate location and elevation:

Southern Parcel 1	
Universal Transverse Mercator (UTM) Zone 19 Coordinates	
317708.01	UTM E (Meters)
4694755.68	UTM N (Meters)
Latitude/Longitude	
42.383709°	Latitude (North)
-71.214428°	Longitude (West)
Elevation	
58	Feet above sea level
Western Parcel 2	
Universal Transverse Mercator (UTM) Zone 19 Coordinates	
318032.00	UTM E (Meters)
4694878.00	UTM N (Meters)
Latitude/Longitude	
42.384886°	Latitude (North)
-71.210534°	Longitude (West)
Elevation	
58-48	Feet above sea level

2.0 SITE RELEASE HISTORY

2.1 240 Beaver Street - Parcel 1

A portion of 240 Beaver Street was assigned Release Tracking Number (RTN) 3-28048 for a release of oil. A Class B-1 RAO was submitted to the Massachusetts Department of Environmental Protection (MassDEP) in October 2009, without remediation conducted, to achieve site closure. A portion of 240 Beaver Street was assigned RTN 3-28050 for a release condition of heavy metals in soil. A Class A-1 RAO was submitted to MassDEP on October 11, 2009 after soil remediation was completed, to achieve site closure. A portion of 240 Beaver Street was the site of an upland fly ash research area in the 1970s. No reportable conditions have been identified in the areas where fly ash was deposited.

In December 2019, the University submitted a Release Notification Form for the presence of chromium, lead and DDT in soil in a filled in area within the southeastern part of the property.

2.2 225-227 Beaver Street - Parcel 2

In 1977, research was conducted at the UMASS experimental station by placing approximately 66-77 tons of municipal incinerator ash residual in two areas (A and B) on 225-227 Beaver Street immediately bordering a wetland, to simulate the effects of landfill disposal in the immediate vicinity of wetlands. According to previous reports, the researchers were unaware that some of the ash was actually placed within the wetlands resource area. Area A was ash placed at grade level over an area of approximately 25 feet x 45 feet. Area B was ash placed approximately 1.8 feet below grade to the north of Area A, within an area of approximately 15 feet x 35 feet. Since the time of ash disposal, the area has become overgrown and there is no visible surficial evidence of the ash disposal cells. Both Areas are currently surrounded by a 6 foot high chain link fence.

The ash disposal research, called the Phoenix Project, is recognized with a metal sign at the Site as a joint project of the United States Environmental Protection Agency (USEPA), the Massachusetts Department of Environmental Quality Engineering (DEQE), currently the MassDEP, and the Massachusetts Department of Public Works (DPW). The conclusion of the research was that metals were considered to have been immobilized by the highly organic soils present.

The Site was first reported to the MassDEP in October 2008, after an investigation detected lead and cadmium in soil that exceeded Reportable Concentrations. This triggered a 120-day reporting requirement and the assignment of RTN 3-28049 by the MassDEP. A Phase I Initial Site Investigation and Phase II Scope of Work report was submitted to the MassDEP in October 2009. The Site was classified Tier II. Comprehensive site investigations defined the degree and extent of heavy metals in soil and groundwater at the Site. Lead, zinc and cadmium in soil and cadmium in groundwater exceeded the Method 1 Risk Characterization Standards. A combined Phase II Comprehensive Site Assessment, Phase III Identification, Evaluation, and Selection of Comprehensive Remedial Action Alternatives, and Class C-1 Temporary Solution RAO Statement report was submitted to the MassDEP in October 2011. A 5-year review of the Temporary Solution was submitted to MassDEP in July 2016.

3.0 SUMMARY OF PHASE II LIMITED SUBSURFACE INVESTIGATION

CDW has made the following observations from the Phase II Subsurface Investigation:

On May 28 and 29, 2019, CDW advanced nine (9) soil borings (GP1-1 to GP1-9) at 240 Beaver St and GP2-1 to GP2-4 at 225 to 227 Beaver Street, respectively. A two-inch diameter monitoring well was installed to a depth of 20 feet in borings GP1-3MW, GP1-5MW, and GP1-7MW at 240 Beaver Street. No wells were installed at 225-227 Beaver Street due to possible bedrock refusal in all three borings and subsequent adjacent boring locations.

Soil samples were collected continuously from samples from each boring and field-screened with a PID for TOVs. One soil sample from each of nine (9) borings was selected and submitted for laboratory analysis for EPH, VPH, VOCs, PCB's, Herbicides, Pesticides, and MCP 14 Metals. Laboratory analysis of soil samples revealed detectable concentrations EPH compounds, total metals, and pesticides. EPH compounds detected in GP1-7 (10-12') and GP1-8 (10-12') are reported below MCP RCS-2 Reportable Concentrations. Low levels of pesticides were detected in GP1-7 (3-5'). Total Metals compounds were detected in GP1-7 (10-12') and GP1-8 (10-12'). Concentrations of Chromium (730 mg/kg), Lead (220 mg/Kg), and DDT (12 mg/Kg). DDT was discontinued in 1972, but residues from historical use still remain.

On June 5, 2019, CDW collected groundwater samples from the newly installed monitoring wells (GP1-3MW, GP1-5MW, and GP1-7MW) and one existing monitoring well MW-2. Groundwater samples were analyzed for EPH, VPH, VOCs, PCB's, and MCP14 metals. Low levels of C9 to C18 Aliphatics and Ethylbenzene were detected in a previously installed one-inch micro well in the vicinity of the former 7,500-gallon fuel oil UST's. Low levels of dissolved metals were detected in all four monitoring wells.

Low levels of pesticides were detected in monitoring well GP1-7MW located in the southern portion of the site. No concentrations exceeded MCP RCGW-2 Standards. Low concentrations of VOC's were detected in monitoring wells GP1-7MW and MW-2. No concentrations exceeded MCP RCGW-2 concentrations.

4.0 SUPPLEMENTAL SUBSURFACE INVESTIGATION

4.1 Topography and Hydrogeologic Features

The Site is located between 48 and 58 feet above sea level, and the topography is generally hilly. According to the USGS geological map the bedrock at the Site consists of diorite and gabbro (Zdigb) (Zen et. al. 1983). The Salem Gabbro-Diorite is described as a Proterzoic mafic plutonic rock that retains its igneous texture with some feldspars and mafic minerals altered to chlorite and epidote. There were no bedrock outcrops observed at the Site.

There are no known drinking water source areas or private well supplies within 500 feet of the Site. The Site is not located within a Potentially Productive Aquifer and no community or known non-community drinking water supply, or MassDEP-approved or interim wellhead protection areas, exist within one mile of the Site.

Federal Emergency Management Agency Flood Insurance Rate Maps indicate that the wet meadow wetland basin is located in a Zone A2 floodplain, which is defined as an area within the 100-year flood zone where base flood elevations and flood hazard factors have been determined. The periphery of this area is designated as a Zone B floodplain, which is defined as an area between the 100 year and the 500-year flood limits. The remainder of southern parcel is located in Zone C floodplain which is outside of the 500-year flood limit.

4.2 Soil Borings

On November 19 through November 21, 2019 CDW completed 27 hand borings within the wetland area of 225-227 Beaver Street, to evaluate the potential migration of previously identified SVOC's or Heavy Metals from the former "Phoenix Project" along the western edge of the wetlands. A grid pattern was established west to east away from the edge of the former fly ash experimental project. The hand borings were completed using a hand auger or post hole digger.

On December 9, 2019 CDW observed the advancement of soil borings on both properties. The soil borings were advanced by track mounted Geoprobe equipped with 5-foot long 2-inch diameter large bore sampling tubes. Soil samples were collected continuously in 5-foot acetate sleeves inserted into large bore sampler to depths up to 15 feet at 240 Beaver Street and up to 10 feet at 225-227 Beaver Street. All soil samples were classified on-site. CDW's subcontractor, Crawford Drilling of Westminster, MA completed the advancement of the soil borings. CDW's subcontractor, Contest Laboratories, Inc. of East Longmeadow, Massachusetts, completed the laboratory sample analyses.

Nine (9) soil borings (GP4-1 to GP4-9) were advanced at the southern fill area at 240 Beaver Street. GP4-1 to GP4-8 were completed to further evaluate the elevated levels of Chromium and Lead which exceeded RCS-1 concentrations in previously completed boring GP1-7. GP4-9 was completed on the access road at the southeast corner of the farm fields where recent illicit dumping of material on the roadway had taken place and observed by farm employees.

On December 9, 2019 CDW observed the advancement of six (6) soil borings (GP3-1 to GP3-6) at 225 to 227 Beaver Street. GP3-1 to GP3-3 were completed in an area approximately 50 feet northeast of the former residence to investigate mounded earth with debris. GP3-4 and GP3-5 were completed

approximately 200 feet to the east of the residence in an area that appeared to have been a former disposal area of glass and other materials. GP3-6 was completed in an approximate area where former motor vehicles and equipment from the farm reportedly had oil changes with the used oil not disposed of in a manner consistent with current state and local regulations.

The current boring locations and previous subsurface investigation locations are depicted on Figure 2 and Figure 3. Soil Boring Logs are presented in Appendix A. No groundwater monitoring wells were installed during the Supplemental Subsurface Investigation.

4.3 Soil Screening and Laboratory Samples

Soil samples were collected continuously from samples from each boring and field-screened with a photoionization detector (PID) using the headspace method. The soil headspace screening results are provided on the boring logs in Appendix A. The PID is an instrument used to quantify total organic volatiles (TOVs) that ionized at or below 10.6 electron volts (a range which includes gasoline and some fuel oil organics). The detection limit for the instrument is 0.1 parts per million (ppm). One soil sample from of eight (8) of the nine (9) borings at 240 Beaver Street and three (3) of the six (6) borings at 225-227 Beaver Street was selected and submitted for laboratory analysis via Semi Volatile Organic Compounds (SVOC's), and MCP 14 metals. In addition, one soil sample was submitted for Extractable Petroleum Hydrocarbon analysis (EPH) and one sample submitted for PCB's. One soil sample from each boring at the depth that exhibited the highest field screening reading or field evidence of contamination was collected. If no field instrumentation readings were registered during drilling, the soil sample was collected from the vadose zone. The samples were preserved by ice and refrigeration, as appropriate, prior to laboratory analysis, and delivered to the laboratory accompanied by an appropriate chain of custody record.

4.4 Groundwater Sampling

Groundwater samples were not collected from the previously installed monitoring wells.

4.5 Groundwater Gauging

Groundwater gauging was not conducted during the supplemental Phase II investigation. Groundwater in the northern portion of 240 Beaver St appears to be flowing in a northeasterly direction toward a wetland area located in the southern portion of 225-227 Beaver Street. Groundwater in the southern portion of the site appears to be flowing in a southwesterly direction towards low wetland areas closest to Waverly Oaks Road. The groundwater flow direction was not calculated at 225-227 Beaver Street.

5.0 NATURE AND EXTENT OF CONTAMINATION

The supplemental Phase II Subsurface Investigation focused on further delineating areas around the southern dumping area at 240 Beaver Street, the fly ash experimental area adjacent to the wetlands and a previously unidentified disposal area at 225-227 Beaver Street.

5.1 Soil and Groundwater Classifications

The selection of a soil classification of RCS-1, as defined in the Massachusetts Contingency Plan (MCP), 310 CMR 40.0361(1)(a), for the comparison of Reportable Concentrations, is applicable to the Site because:

- The soil sample locations are located within 500 feet of a residential property.
- The property is zoned as a recreational area and is open to the public.

The selection of a groundwater classification of RCGW-2, as defined in the MCP, 310 CMR 40.0362, for the purpose of identifying Reportable Concentrations, was based upon the following criterion:

- RCGW-2 shall be applied to all groundwater cases not involving GW-1 classification.

5.2 Soil/Sediment Sample Analysis Results

The results of the soil and sediment sample analysis were reviewed. The results of all soil analyses are summarized in Table 1. Copies of the laboratory analytical reports are included in Appendices B, C and D.

225-227 Beaver Street – Wetland Sampling

CDW collected hand borings at 27 locations within the wetland area and collected sediment samples from 6-12" below the surface. From those borings, 20 soil samples were submitted and analyzed for SVOC's and MCP14 Metals. The hand boring locations were established in a rough grid pattern based on safe access to various locations within the wetland.

Hand boring laboratory analytical results are summarized in Table 3 and compared with MassDEP's Revised Sediment Screening Values. The sediment screening values are intended for use in Stage I Environmental Risk Characterization for sites where oil or hazardous material has been released or migrated to sediment. Stage I sediment screening values are used to evaluate the need for a quantitative Stage II Environmental Risk Characterization.

Hand borings HB-1 through HB-5 were completed directly east of the "fly ash" area. HB-5 identified Antimony (32 mg/Kg), Lead (2,700 mg/Kg), Silver (130 mg/Kg), and Zinc (5,100 mg/Kg). The remaining borings: HB-6 through HB-11, HB12 through HB-18, HB-19 through HB-23, HB-24 through HB-26, and HB-27 were completed in approximate 180 foot grids from the fly ash disposal area and the eastern property line.

Concentrations of lead and zinc closest to the original ash disposal area exceeded the sediment screening values. In addition, lead concentrations exceeded sediment screening values in hand borings HB-6, HB-7, HB-8, HB-9, HB-10, HB-14, HB-19 and HB-24. HB-6 is located hydrologically upgradient of the ash disposal area but is the closest sample location to the glass and ash disposal area. Lead concentrations that exceeded sediment screening values in HB-19 and HB-24 are located on the other side of the stream

bed along the eastern property line and may be attributed to a former railroad siding and tracks that are still visible along the property boundary. Trace levels of semi-volatile organic compounds were also identified hand borings HB-6, HB-7, HB-9, HB-10, HB-14, HB-19, and HB-24.

A sediment sample collected from HB-5 (0-1') was submitted to Microvision Laboratories for Microscopic Analysis for Coal, Coal Ash, and Wood Ash. Results indicated the presence of coal, coal ash, and wood ash.

240 Beaver Street – Geoprobe Drilling

Soil samples from the southern fill area were submitted and analyzed for Semi-Volatile Organic Compounds (SVOC') and MCP14 metals. On soil sample from boring GP4-2 was submitted for PCB's based on visual observations of a caulking-like material from 3-5 feet below grade during the subsurface investigation.

Laboratory analysis of soil samples did not identify detectable concentrations of SVOC's above laboratory minimum detection limits. Concentrations of arsenic, barium, beryllium, cadmium, chromium, lead, nickel, vanadium, and zinc were identified in borings supplemental borings GP4-1 through GP4-7, and GP4-9. The concentrations of metals did not exceed RCS-1 concentrations. The caulk-like material from soil boring GP4-2 (6-8') reported PCB's (66 mg/Kg) above RCS-1 concentrations.

A soil sample collected from GP4-1 (3-5 feet) was submitted to Microvision Laboratories for Microscopic Analysis for Coal, Coal Ash, and Wood Ash. Results did not indicate the presence of coal, coal ash, or wood ash.

225-227 Beaver Street- Geoprobe Drilling

An apparent dumping area of glass and ash was observed during the wetland sampling event in November 2019. The glass and ash area appeared approximately 1 to 2 feet thick. The disposal area appeared approximately 50 to the west of the wetland edge. Laboratory analysis of soil samples collected from this disposal area identified elevated concentrations of lead. Concentrations of lead were reported in GP3-4 (3-5') at 1,000 mg/Kg and GP3-5 (3-5') at 1,100 mg/Kg within this disposal area. Both soil samples exceeded RCS-1 concentrations for lead. An additional soil sample was submitted to Microvision for analysis for coal or coal ash. The results confirmed the presence of coal or coal ash within the sample.

Laboratory analysis of soil samples collected from a reported former oil changing area identified EPH fractions below RCS-1 standards.

6.0 CONCLUSIONS

The Supplemental Phase II Site Investigation was implemented to further delineate areas of potential environmental impact previously identified in the Phase II Limited Site Investigation. The Supplemental Site Investigation further evaluated a portion of the property at 225-227 Beaver Street and the southern part of 240 Beaver Street. Based upon the results of the supplemental soil and sediment testing and site observations, CDW is presenting our conclusions and a summary of the key observations upon which these conclusions are based. From this study, CDW has made the following conclusions:

240 Beaver Street

Soil borings were completed in the southern fill area to further delineate the soil conditions in the vicinity of GP1-7 and assess the observed area of past dumping practices.

Soil borings in this area identified fill material containing varying amounts of black fine sand with minor amounts of brick, concrete, gravel and tan to gray sand. This material could represent historic fill if consistent with nearby soil observations; however, after a review of aerial maps, soil borings, personnel interviews, and other sources, this material appears to be unique, and emplaced over a long period of time, which expanded an otherwise steep embankment. A soil sample from this area was submitted to Microvision to identify the potential presence of coal, coal ash or wood ash. The results were negative for those components. Therefore, the presence of heavy metals was not exempt from reporting and will require additional filings under the Massachusetts Contingency Plan.

The presence of PCBs at concentrations that exceeded 50ppm is an illegal use and disposal of this material. The source and extent of the material is unknown. The U.S. EPA regulations would require removal or capping of these materials to eliminate the risk of human exposure to PCBs.

225-227 Beaver Street

Hand borings HB-1 through HB-27 were completed within the wetland to the east of the "fly ash" disposal area. The highest concentrations of heavy metals were in HB-5, the southernmost sample location directly adjacent to the original ash disposal area. Metals detected included Antimony, Lead, Silver, and Zinc. Concentrations of lead in multiple locations exceeded the MassDEP sediment screening values, including a wetland location close to an upland glass and ash dumping area. The lead concentration in sediment sample HB-14 exceeded the screening value and is notable for its location beyond the previously known extent of lead within the wetland. Lead concentrations in two sediment sample locations along former railroad tracks at the northeast property boundary also exceeded the screening value.

A Stage II Environmental Risk Characterization would be required to verify whether the current concentrations of heavy metals in the wetland resource area represent a significant risk to the environment if left in place. In addition, a Method 3 risk characterization should be used to evaluate the ash disposal areas, and additional feasible options considered for achieving a Permanent Solution that would allow for future uses. Groundwater was not tested during this investigation; however, prior investigations identified the presence of cadmium in groundwater that exceeded the standards at that time.

The Site is regulated under the MCP and has achieved a Class C Temporary Solution. In accordance with the MCP, 310 CMR 40.1050(4)(b), a Periodic Review of the Temporary Solution shall be conducted

every fifth year after the date of filing the Temporary Solution Statement, until such time that a Permanent Solution Statement is submitted. Such Periodic Review Opinion shall include primarily: an evaluation of the feasibility of implementing one or more permanent solutions for the disposal site, effectiveness of the Temporary Solution(s), and definitive and/or enterprising steps taken to identify, develop and implement a feasible Permanent Solution at the Site. If a Permanent Solution has not been achieved, the next 5-year Periodic Review Opinion is due October 2021.

Soil borings were completed to the northeast of the former residential house to assess the possible man-made mounding used for disposal purposes. Geoprobe drilling of the elevated mound identified the presence of bedrock covered in a loamy soil. Samples for laboratory analysis were not collected and no unusual environmental conditions were noted.

An apparent dumping area of glass and ash was observed during the wetland sampling event in November 2019. The glass and ash area appeared approximately 1 to 2 feet thick. The disposal area appeared approximately 50 to the west of the wetland edge. Two soil samples were submitted from this disposal area. Both soil samples exceeded RCS-1 concentrations for lead. An additional soil sample was submitted to Microvision for analysis for coal or coal ash. The results confirmed the presence of coal or coal ash within the sample. In accordance with the 2016 Historic Fill / Anthropogenic Background Public Comment DRAFT Technical Update, the material cannot be considered anthropogenic background as Historic Fill, as it primarily consists of coal or coal ash that was emplaced in this location. Therefore, the concentrations of lead within the glass and ash dumping area are reportable by the Site owner to the MassDEP within 120 days of their knowledge.

One boring was completed south of the former calf barn where it was reported that motor oil and oil from small engines would be disposed of by allowing the oil to spill onto the ground. One soil boring was completed in December 2019 and identified low levels of C19-C36 aliphatics (120 mg/Kg) and C11 to C22 aromatics (52 mg/Kg). EPH concentration did not exceed RCS-1 Standards and no further action is required at this time.

7.0 LIMITATIONS

This investigation was intended to provide a general assessment of current subsurface conditions and was limited in nature and scope. The findings are limited to the information available at the time of the investigation and the scope of services as defined. The results of the limited subsurface exploration performed on this Site provide the basis for the findings and are representative of conditions at the time of the investigation. No other conclusions, interpretations, or recommendations are contained or implied in this report other than those expressed. Also, CDW makes no warranty, expressed or implied, on the accuracy of the work and information completed by others and upon which CDW has relied to prepare this report. No other use of this report is warranted without the written consent of CDW Consultants, Inc.

